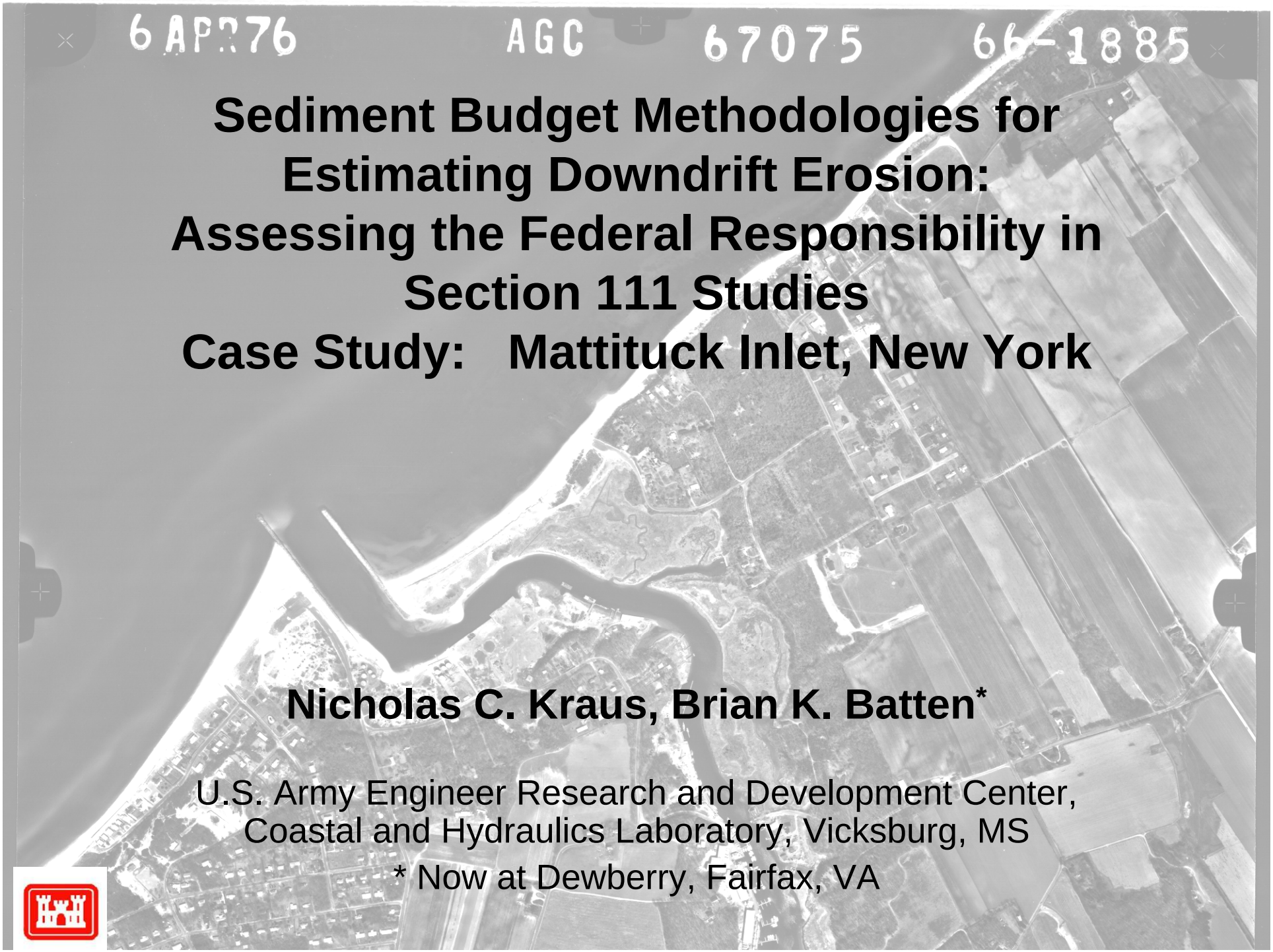

Sediment Budget Methodologies for Estimating Downdrift Erosion: Assessing the Federal Responsibility in Section 111 Studies
Case Study: Mattituck Inlet, New York

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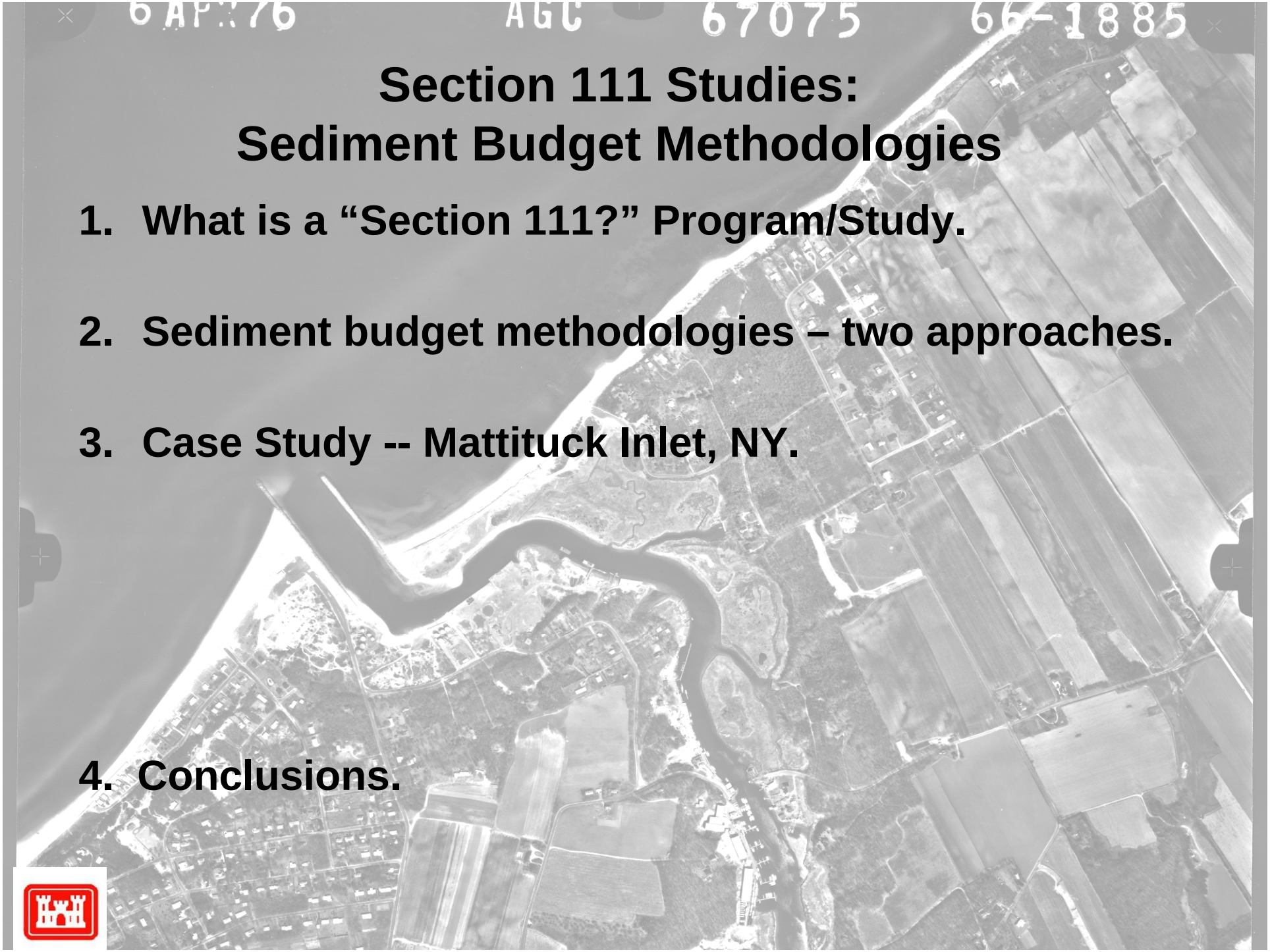


Section 111 Studies: Sediment Budget Methodologies

1. What is a “Section 111?” Program/Study.

2. Sediment budget methodologies – two approaches.

3. Case Study -- Mattituck Inlet, NY.

4. Conclusions.

1. What is a Section 111 Study?
(caveat: the speaker is not a Corps planner!)

- Under the Continuing Authorities Program (CAP)
- ER-1105-2-100 Appendix F, Amendment #, 31 Jan 06
- The term “Continuing Authorities Program” or “CAP” encompasses a group of 10 legislative authorities under which the Secretary of the Army, acting through the Chief of Engineers, is authorized to plan, design, and implement certain types of water resources projects without additional project-specific congressional authorization.

TABLE F-1 CAP AUTHORITIES

AUTHORITY	PURPOSE
Section 14:	Streambank & shoreline erosion protection of public works & non-profit public services
Section 103:	Beach erosion and hurricane and storm damage reduction
Section 107:	Navigation improvements
Section 111:	**Shore damage prevention or mitigation caused by Federal navigation projects**
Section 145:	Placement of dredged material on beaches
Section 204:	Beneficial uses of dredged material
Section 205:	Flood control
Section 206:	Aquatic ecosystem restoration
Section 208:	Removal of obstructions, clearing channels for flood control
Section 1135:	Project modifications for improvement of the environment

Section 111 Authority

Section 111 of the River and Harbor Act of 1968, as amended

The Secretary of the Army is authorized to investigate, study, plan, and implement structural and nonstructural measures for the **prevention or mitigation of shore damages attributable to Federal navigation works and shore damage attributable to the Atlantic Intracoastal Waterway and the Gulf Intracoastal Waterway**, if a non-Federal public body agrees to operate and maintain such measures, and, in the cases of interests in real property acquired in conjunction with nonstructural measures, to operate and maintain the property for public purposes in accordance with regulations prescribed by the Secretary.

The cost of implementing measures under this section shall be **cost-shared** in the same proportion as the cost-sharing provisions applicable to the project causing the shore damage. No such project shall be initiated without specific authorization by Congress if the Federal first cost exceeds $5,000,000.

“Shore Damage Attributable to Federal Navigation Project”

So, the objective of a S 111 study is to assess the Federal responsibility for erosion attributable to a Federal Navigation project, 0 to 100%

2. Two Technical Evaluation Approaches

- "Shore damage" in S 111 language ➔ volume of erosion or volume owed.
- Can determine volume owed through sediment budget (tally of sand inputs, outputs, volume change in a given control cell).
- Alternative sediment budget approaches:
  - Explicit or direct shoreline change assessment (observed shoreline change converted to volume).
  - Implicit or indirect shoreline change assessment (sediment budget – tally of various volumes).
- End result is a volume owed (+/- an uncertainty) as the manifestation of the Federal responsibility.

Explicit (Direct) and Implicit (Indirect) Sediment Budget Methods

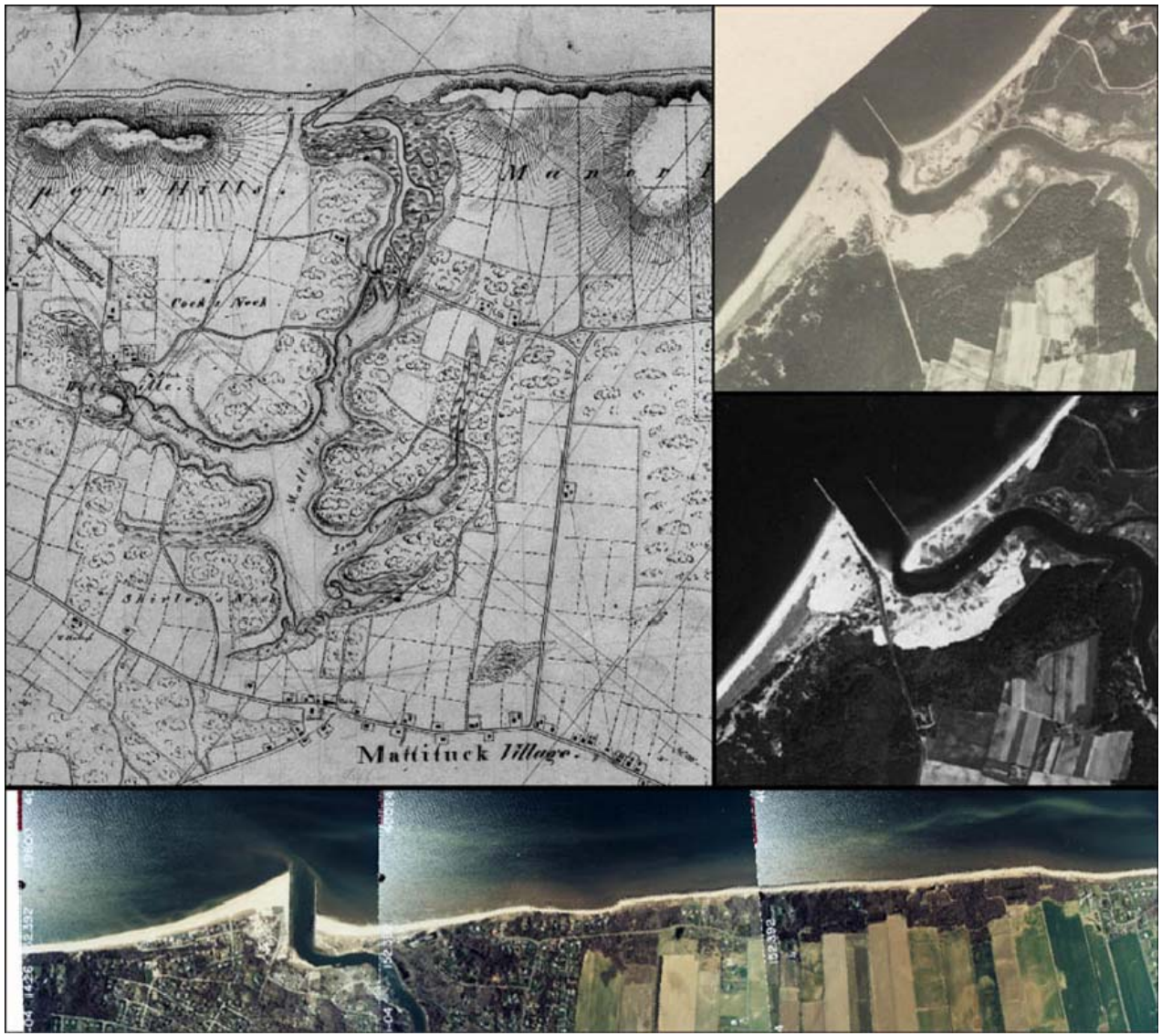
Explicit Method

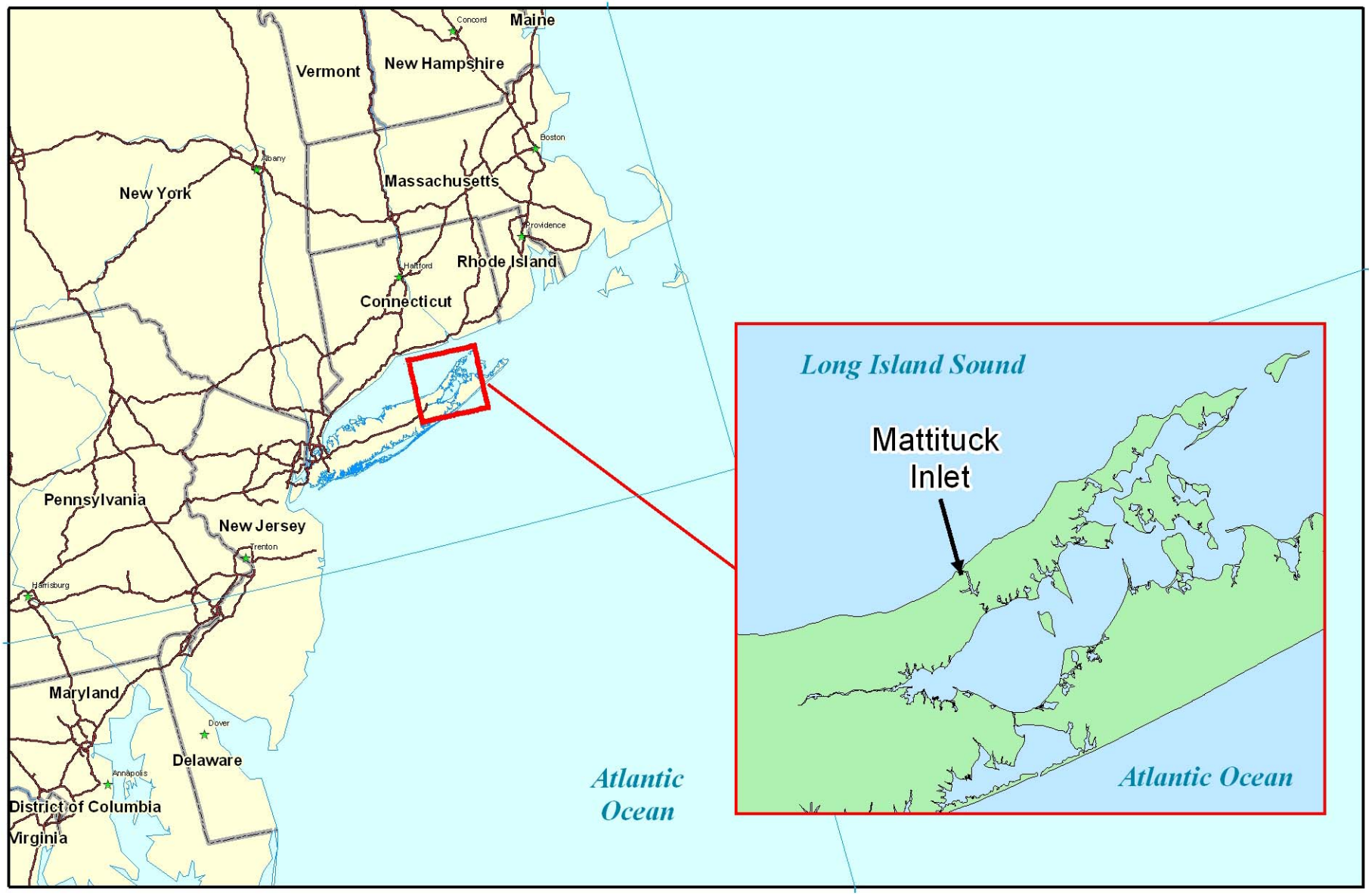
- Depends on measured shoreline change as through a GIS analysis. (Requires assumptions about the beach profile to obtain a volume from shoreline change.)
- Area of shore damage determined directly by method.

Implicit Method

- Depends on calculated or estimated longshore sand transport rates at boundaries of calculation area, and various sediment volumes (impounded, dredged, mined…).
- Area of shore damage not directly determined by method. (What are the boundaries?)

3. Case Study – Mattituck Inlet, NY

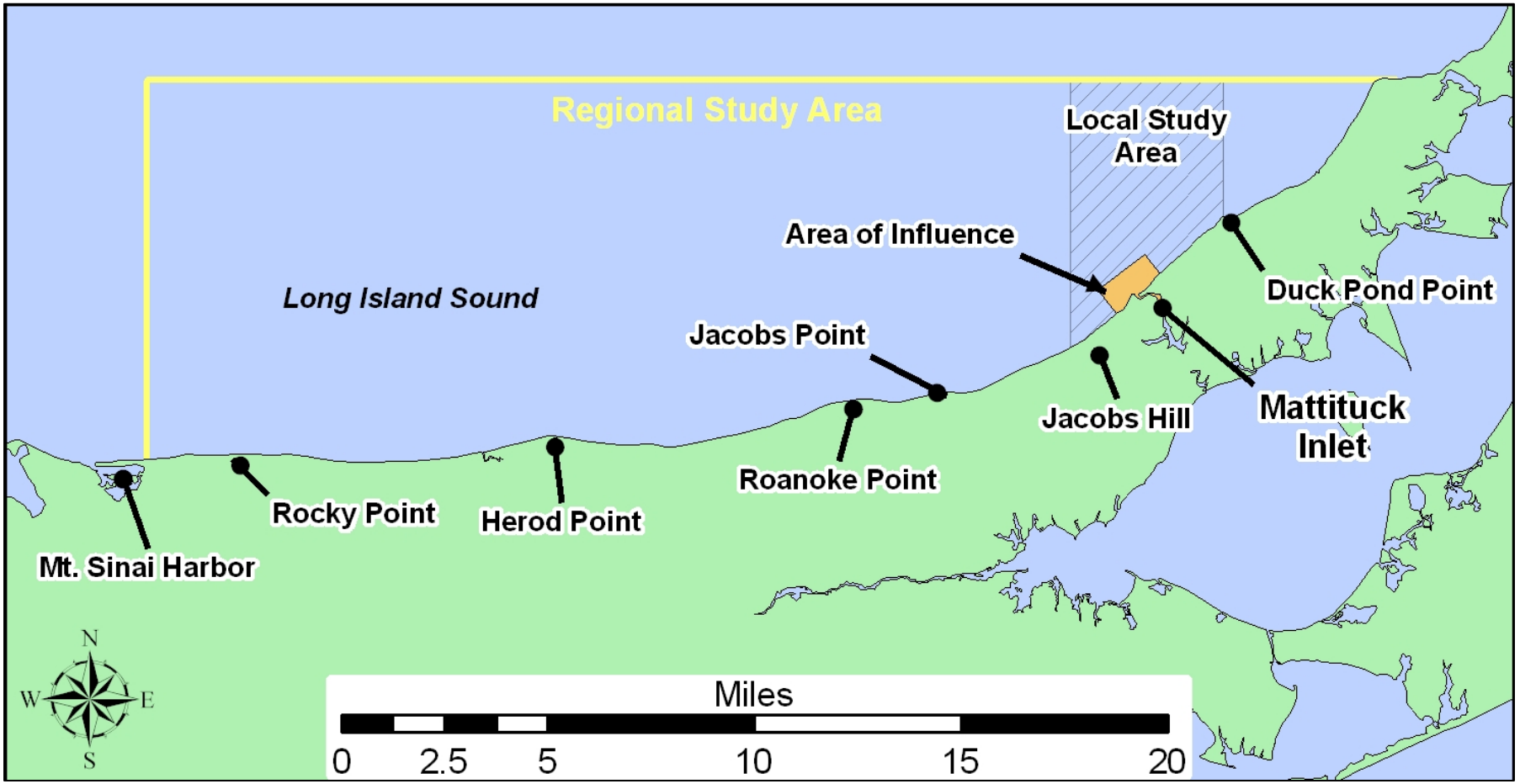



Maine
Concord
Vermont
New Hampshire
Boston
Albany
New York
Massachusetts
Providence
Rhode Island
Hartford
Connecticut
Pennsylvania
New Jersey
Trenton
Harrisburg
Maryland
Dover
Delaware
Annapolis
District of Columbia
Virginia
Atlantic Ocean
Long Island Sound
Mattituck Inlet
Atlantic Ocean

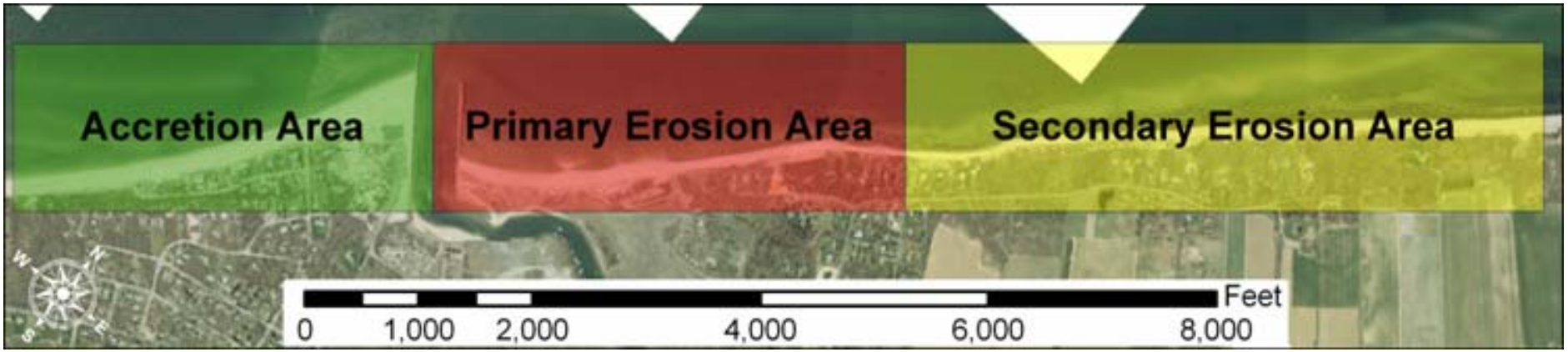
Mattituck Inlet, NY

- On northeastern shore of Long Island, facing LI Sound.
- Tide range ~ 5-6 ft, waves relatively small because of limited fetch.
- Geologic setting glacial (cliffs, gravel, glacial erratics…)
- Historic, pre-existing inlet.
- Old Federal project – studies started in 1880's.
- Two rubble mound jetties constructed in 1906 to 9-ft contour then extended to 12-ft contour; repaired & modified over the years; channel to 7 ft.
- Sediment budget complicated by extensive gravel mining (documented and undocumented) from ~ 1920s-1960s. Entrance channel gravel-mined to 20-ft depth.
- Channel cross-sectional area now much larger than empirical relations predict.

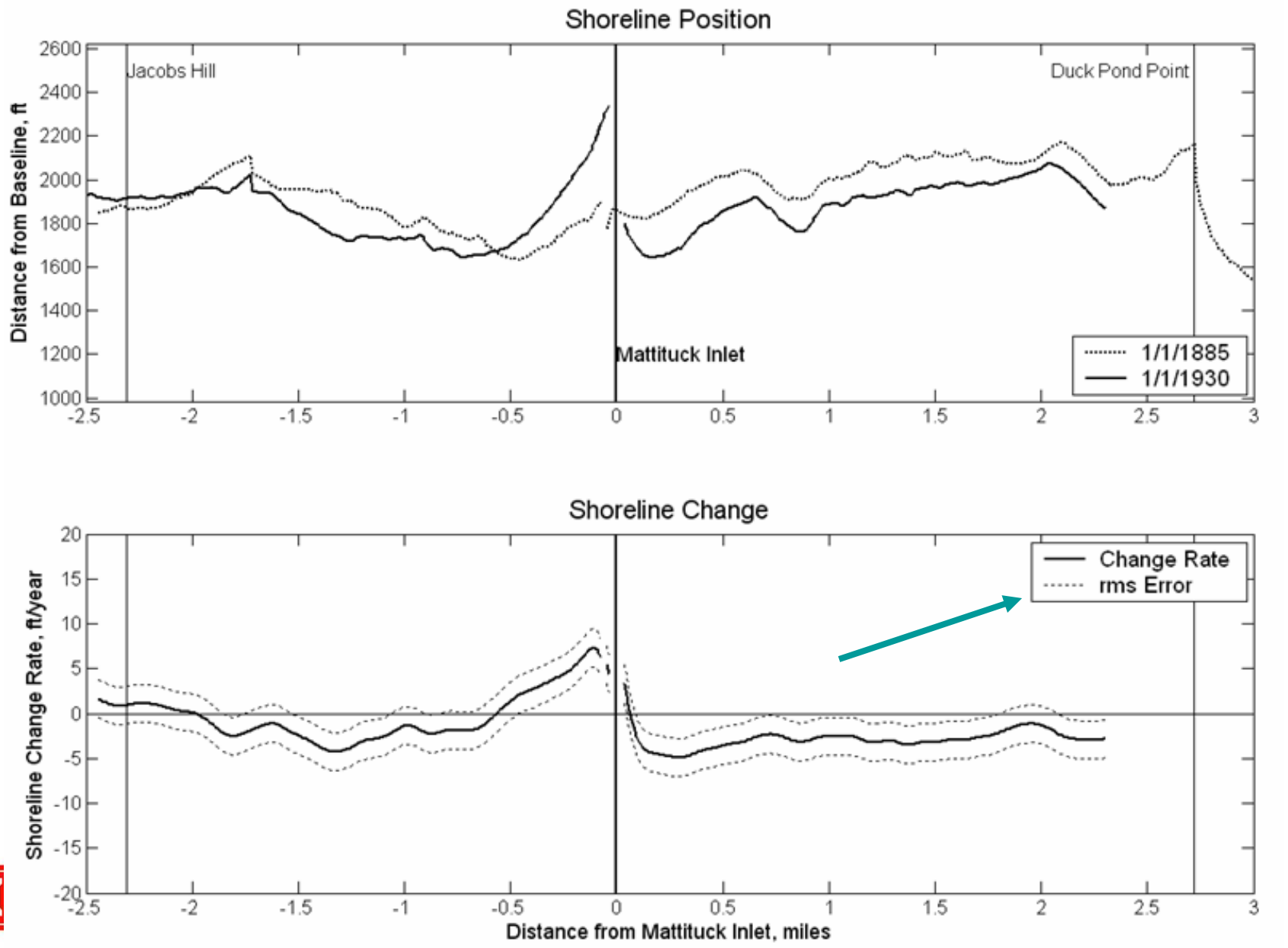
Area of Influence of inlet determined by shoreline change rates (explicit method)

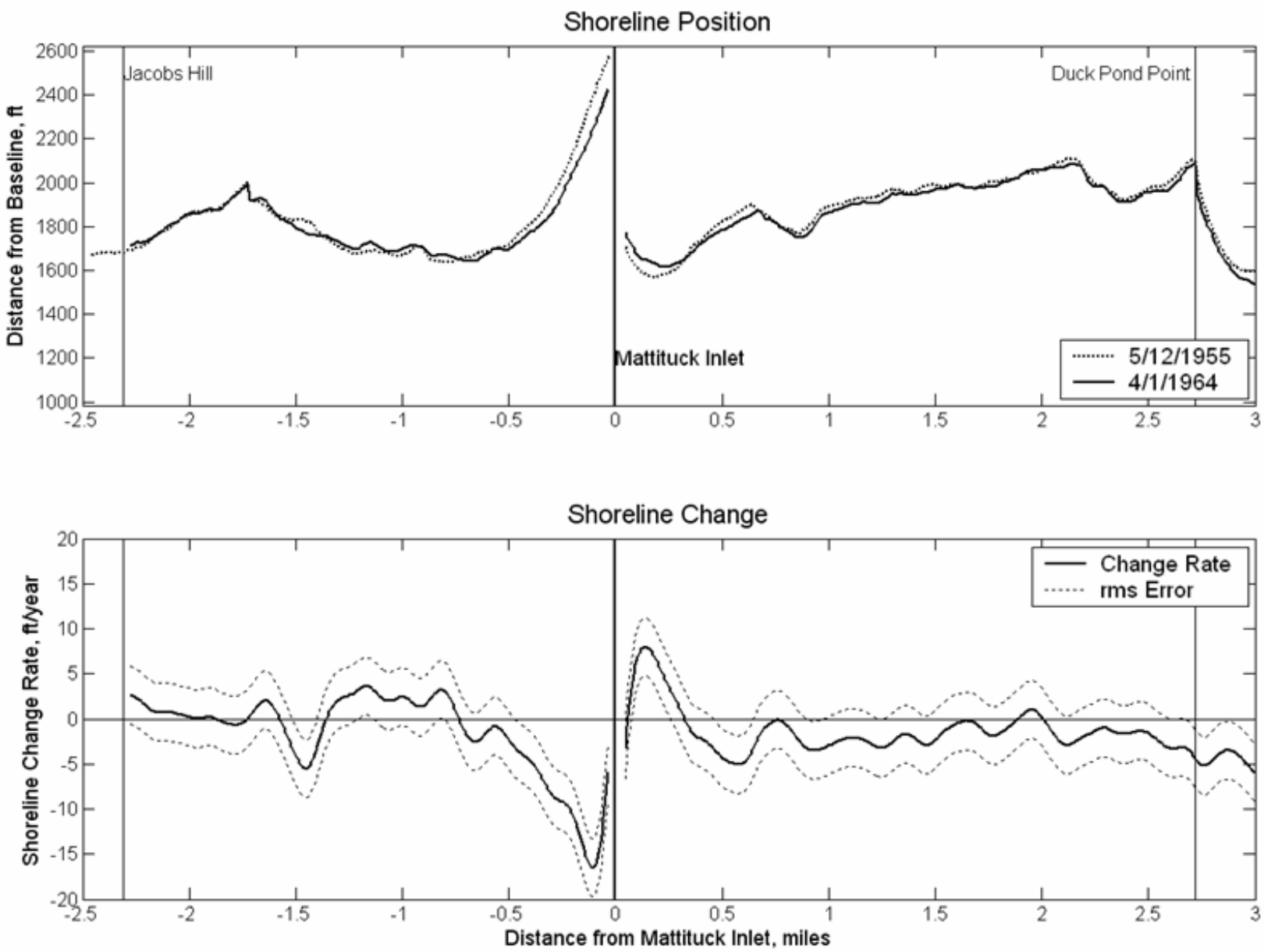


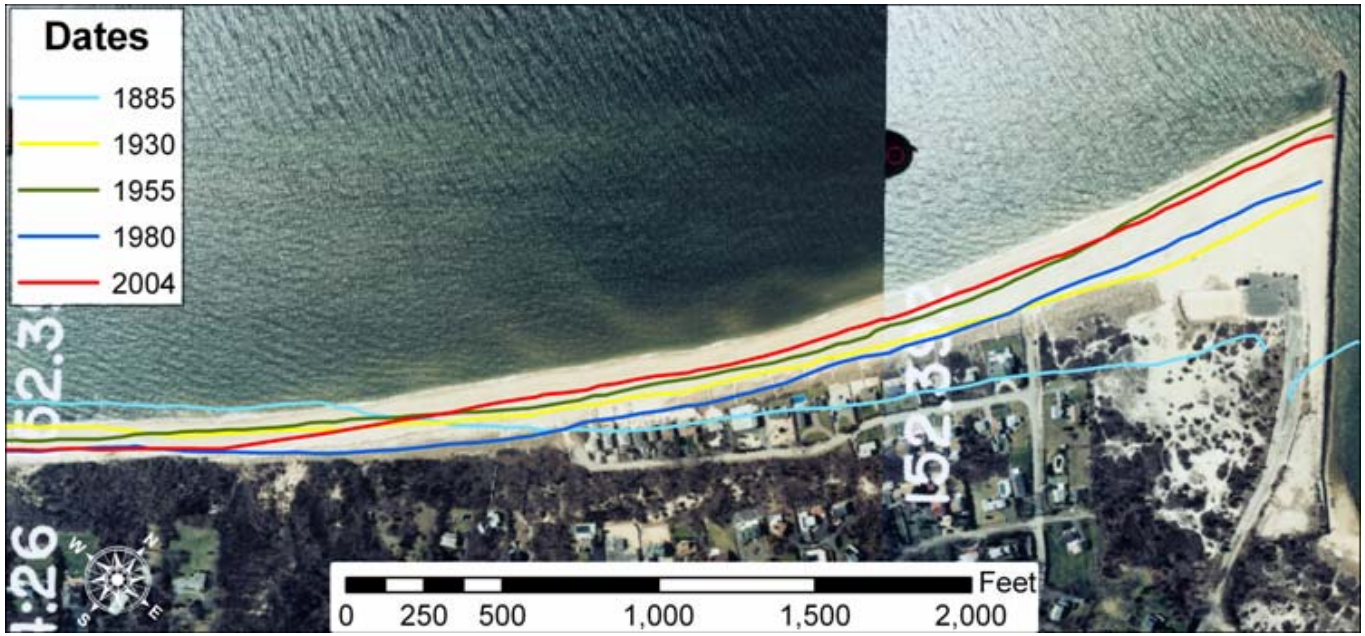
Shoreline Analysis Identified Areas of Beach Change

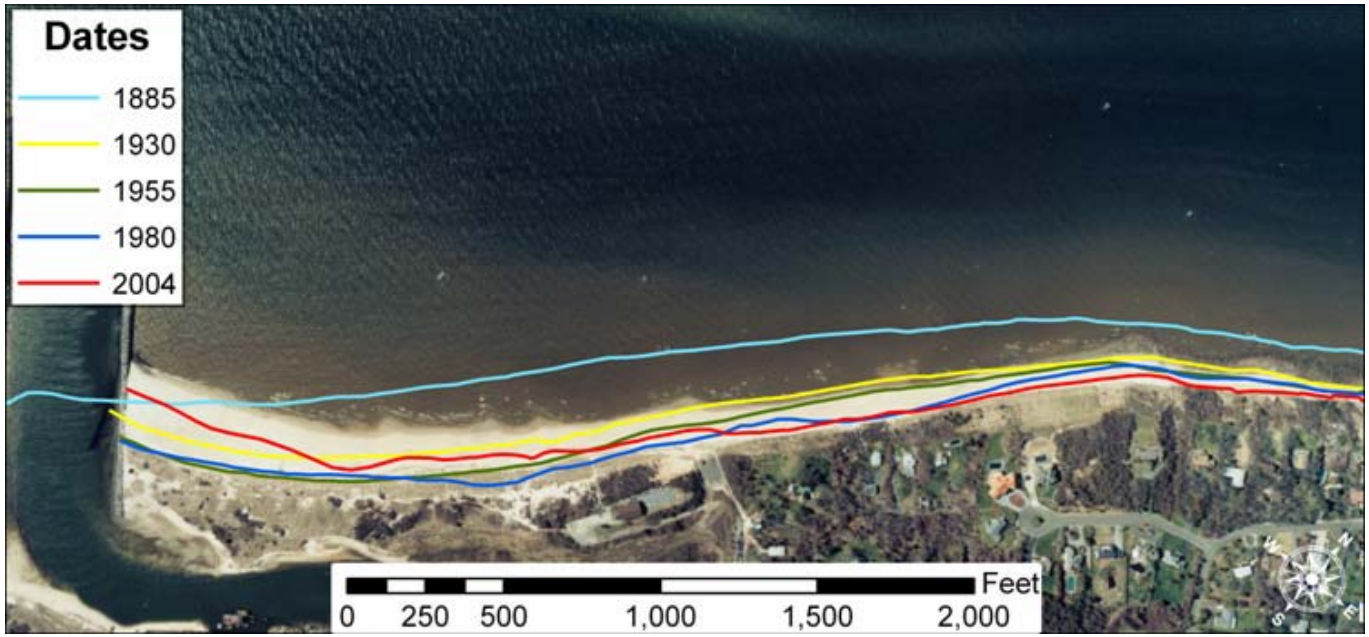


Example of Shoreline Position Data

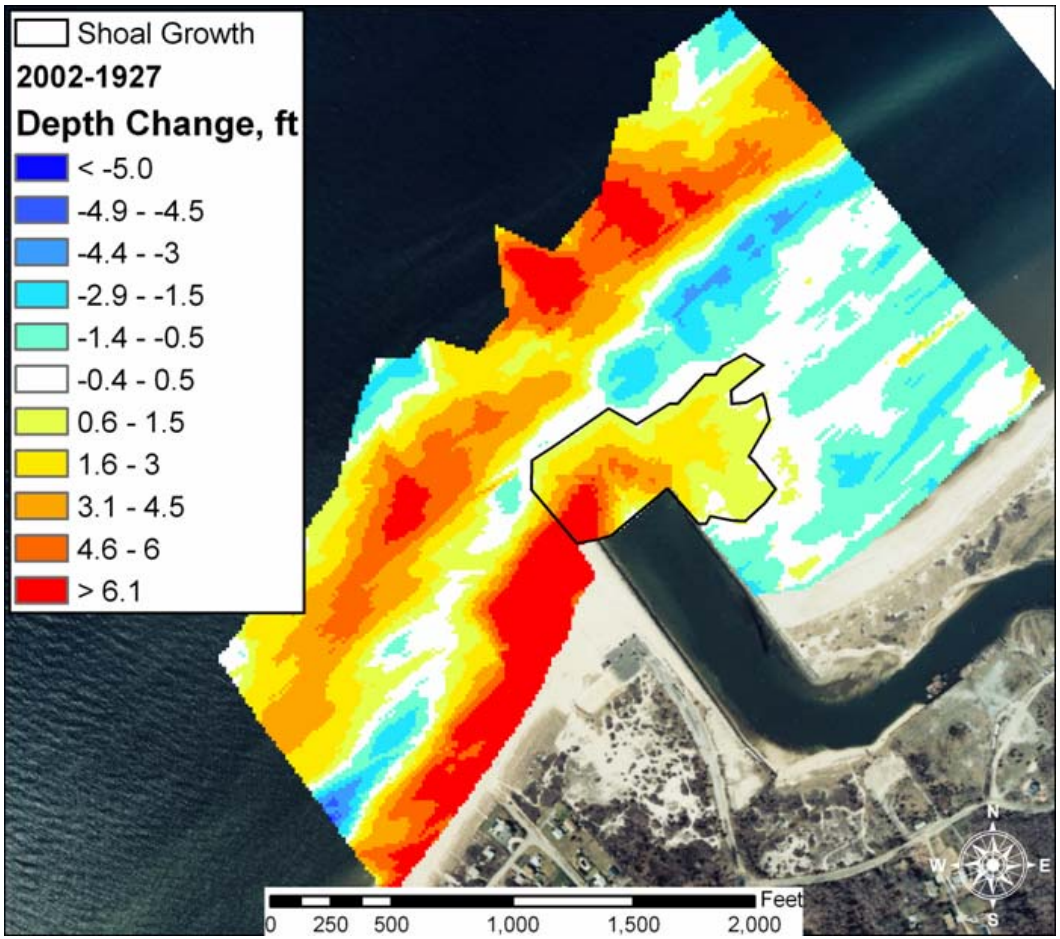



Shoreline Position
Distance from Baseline, ft
Jacobs Hill
Duck Pond Point
Mattituck Inlet
5/12/1955
4/1/1964
Shoreline Change
Shoreline Change Rate, ft/year
Change Rate
rms Error
Distance from Mattituck Inlet, miles


Dates
1885
1930
1955
1980
2004
Feet
0 250 500 1,000 1,500 2,000


Dates
1885
1930
1955
1980
2004
Feet
0 250 500 1,000 1,500 2,000

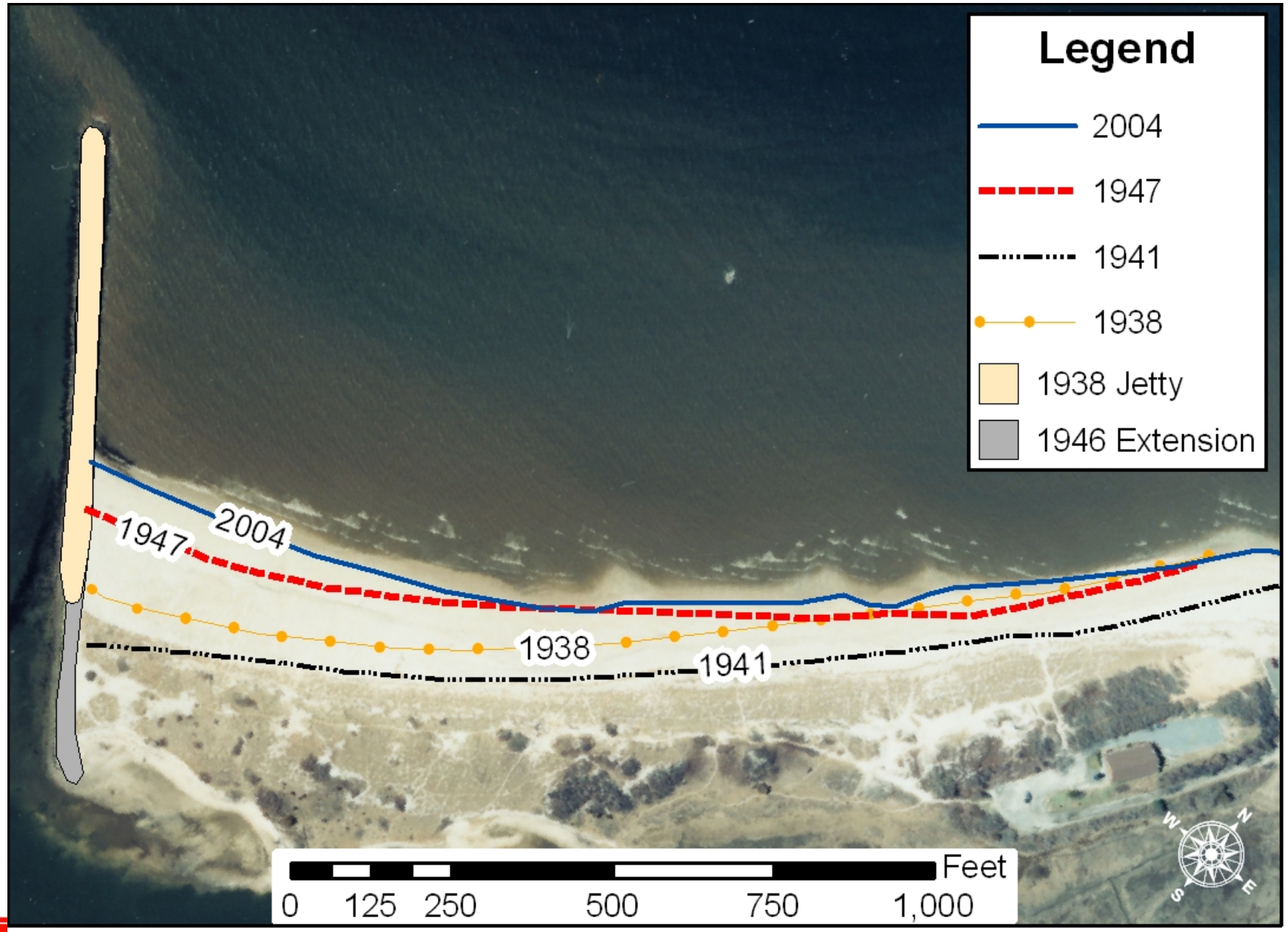
Many kinds of data analyzed in this study



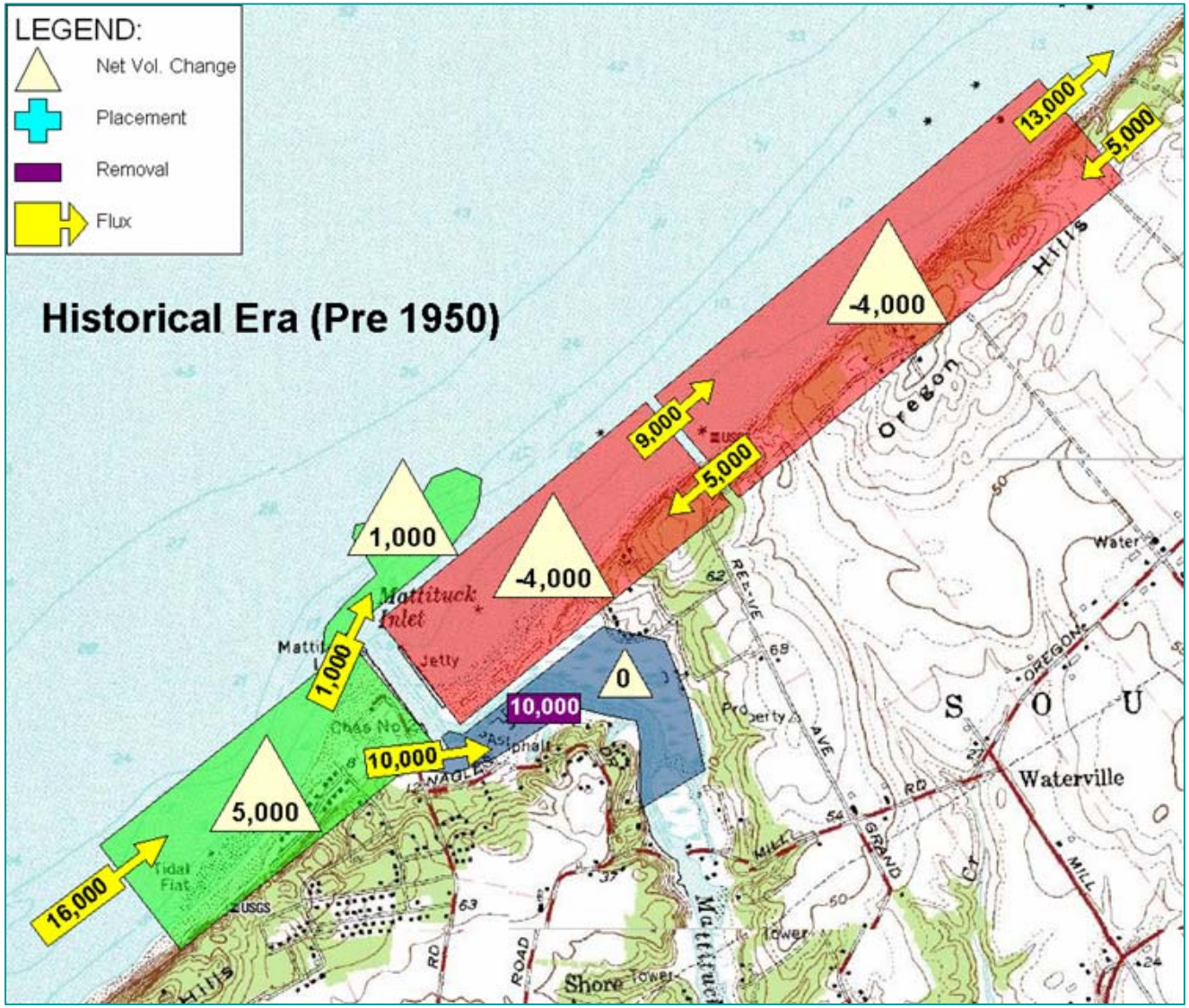
Depth change between 1927 and 2002 (2001 photograph)

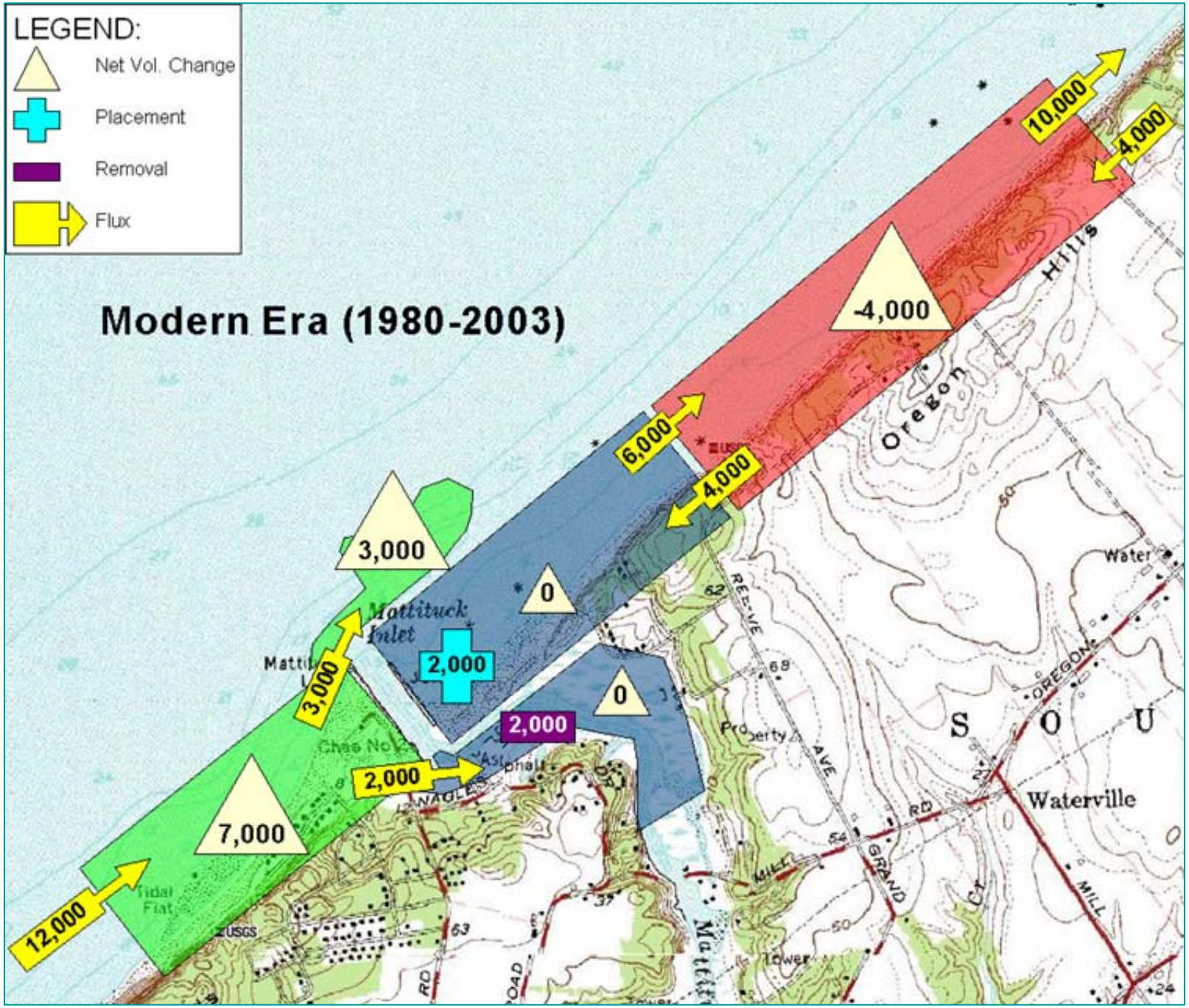
Examples of Data Analyzed

- Shoreline positions, regional and local.
- Beach profile data (taken for this study).
- Bathymetry.
- Changes in Mattituck Channel (flood shoal).
- Wave data (almost nil).
- Sediments and sediment source from cliff erosion.
- Dredging & dredged-material placement.
- Gravel mining from channel – inspected permits going back to 1920s.
- Jetty construction and modifications.
- Inferred sediment pathways from bathymetry change, modeling, etc.

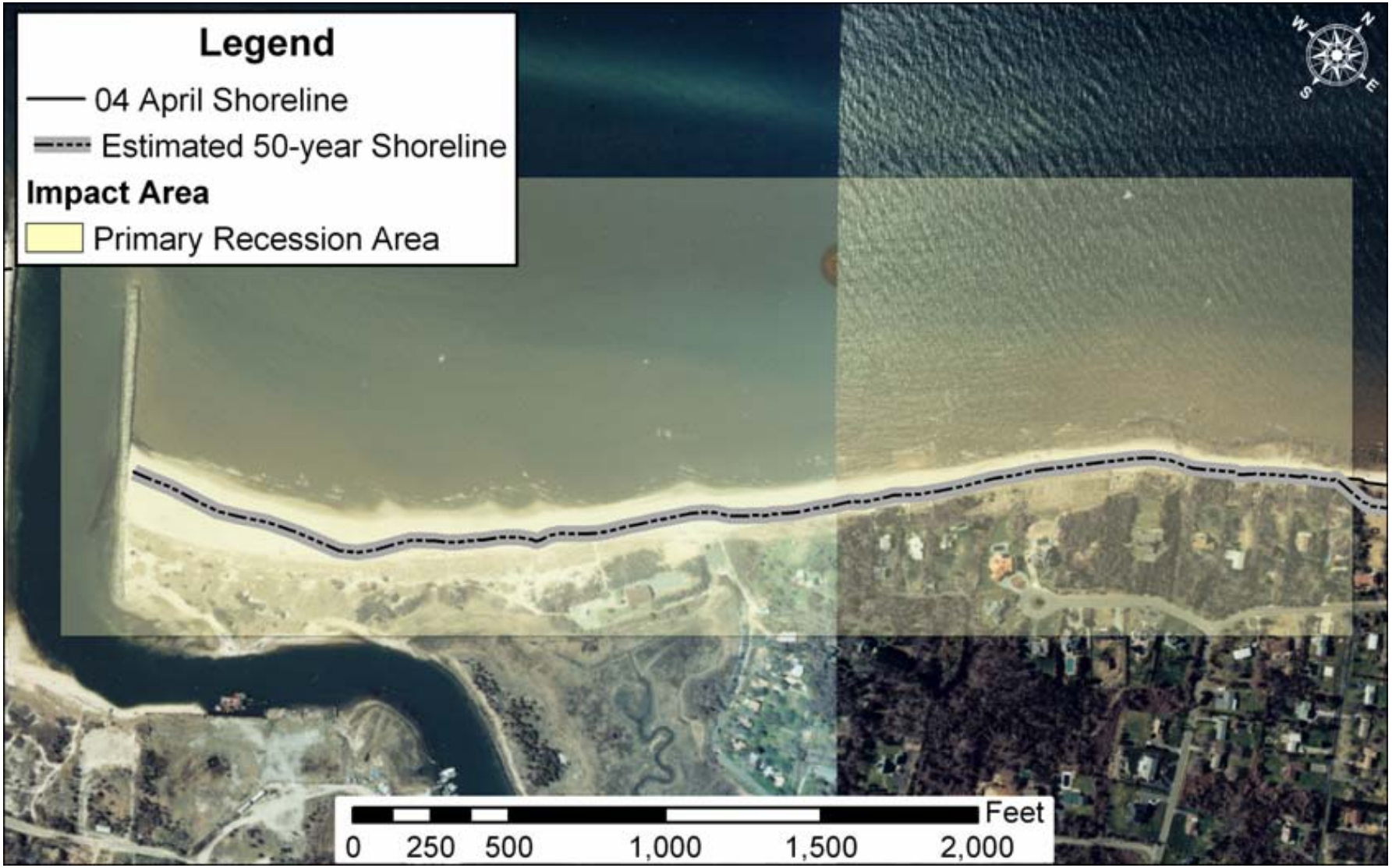

Legend
2004
1947
1941
1938
1938 Jetty
1946 Extension
2004
1947
1938
1941
Feet
0
125
250
500
750
1,000
N
E
S
W

Sediment Budgets, Different Eras (explicit method)




LEGEND:
Net Vol. Change
Placement
Removal
Flux
Modern Era (1980-2003)
-4,000
10,000
4,000
6,000
4,000
3,000
0
2,000
3,000
0
2,000
2,000
7,000
12,000
Mattituck Inlet
Tidal Flat
Asphalt
Oregon
Hills
Waterville
OREGON
Property
AVE
RD
GRAND
MILL
REEVE
Tower
USGS

Future “without-project”



Implicit Method

- Calculating “volume denied” by Federal navigation project.
- Volume estimates from calculated longshore transport rates into and out of identified area, volume impounded, volume bypassed by dredged-material placement and naturally, volume mined from channel and channel infilling, volume change in ebb and flood shoals, volume change offshore, etc.
- Down-drift extent could be infinite – reasonable, practical?
- Can also be analyzed in eras if have adequate data.

$$V_{Fed} = V_{tot} - V_p - V_{mNF} - V_o$$

Total Volume Loss Attributable to Mattituck Inlet Federal Navigation Project	
V_{tot}	**Volume, cu yd**
$(V_{tot})_1$ Longshore transport lost to down-drift beaches	1,038,000
$(V_{tot})_2$ Impoundment and dredging	1,019,000
$(V_{tot})_{2a}$ Federal mining	1,104,000
$(V_{tot})_{3a}$ Non-Federal mining, low estimate	1,547,000
$(V_{tot})_{3b}$ Non-Federal mining, high estimate	2,007,000

4. Conclusions

Comparison of Approaches for Assigning Federal Responsibility, Mattituck Inlet, Volume Owed

Explicit Method

- 235,000 cu yd (± 91,000 cu yd).
- Defined areas of impact – measurable, not theoretical.
- Smaller error bound than implicit method.

Implicit Method

- 493,500 cu yd (± 250,000 cu yd) .
- Downdrift impact area extends to infinity.
- In this study, gravel mining yielded great uncertainty.

Thanks for your attention. Questions?

Down-drift beach at Mattituck Inlet

Section 111 study at Mattituck Inlet sponsored by the USACE New York District